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A REVISION OF THE MAMMALIAN GENUS *MACROTUS*.

BY JAMES A. G. REHN.

During the preparation of this paper a series of one hundred and eighty-five specimens have been examined, seventy-six preserved as skins, the remainder being in alcohol. This interesting collection, representing the material of this genus preserved in the leading American institutions, was from the following collections: ninety-two from the Biological Survey of the U. S. Department of Agriculture, fifty from the U. S. National Museum, thirty-one from the American Museum of Natural History, five from the Field Columbian Museum, and the remainder from the collection of the Academy. The author wishes to thank Drs. C. Hart Merriam, J. A. Allen and D. G. Elliot, and Mr. G. S. Miller, Jr., of the above institutions, for their kindness in permitting the use of specimens, and also for replies to inquiries regarding the same.

MACROTUS Gray.¹

1843. *Macrotus* Gray, Proc. Zool. Soc. London, 1843, p. 21. Type, *Macrotus waterhousii* Gray.
 1855. *Macrotus* Wagner, Suppl. Schreber's Säugthiere, V, p. 639.
 1858. *Macrotus* Baird, Proc. Acad. Nat. Sci. Phila., 1858, p. 116.
 1859. *Macrotus* Baird, Rep. U. S. and Mexican Boundary Survey, Vol. II, Pt. ii, Mamm., p. 3.
 1860. *Macrotus* Saussure, Revue et Magasin de Zoologie, 2^e serie, XII, p. 486.
 1864. *Macrotus* H. Allen, Monograph Bats N. Amer., p. 1.
 1864. *Macrotus* Gundlach, Monatsb. K. Preuss. Akad. Wissensch., Berlin, 1864, p. 382.
 1865. *Macrotus* Peters, Monatsb. K. Preuss. Akad. Wissensch., Berlin, 1865, p. 503.
 1875. *Macrotus* Coues and Yarrow, Rep. Expl. Surv. W. 100th Merid., V, p. 80.
 1878. *Macrotus* Dobson, Catal. Chiropt. Brit. Mus., p. 463.
 1879. *Macrotus* Alston, Biol. Cent.-Amer., Mamm., p. 36.
 1890. *Macrotus* H. Allen, Proc. Amer. Philos. Soc., XXVIII, p. 73.
 1891. *Otopterus* Lydekker, in Flower and Lydekker, Mammals Living and Extinct, p. 673.
 1894. *Macrotus* Allen, Monograph Bats N. Amer., 1893, p. 33.
 1898. *Otopterus* Merriam, Proc. Biol. Soc. Wash., XII, p. 18.
 1899. *Otopterus* Nelson, North American Fauna, No. 14, p. 18.
 1901. *Otopterus* Elliot, Field Columb. Mus. Publ., Zool. ser., Vol. II, p. 419.
 1904. *Macrotus* Miller, Proc. U. S. Nat. Mus., XXVII, p. 344.

¹ As the author does not consider that *Macrotis* Dejean invalidates this name, he has retained the term applied by Gray. The name *Macrotus* Leach (*Syst. Cat. Spec. Indig. Mamm. Birds Brit. Mus.*, 1816, p. 5) is a *nomen nudum*, and therefore has no standing. For discussion of the *Macrotus-Otopterus* question see True and Allen (Allen, *Monogr. Bats N. Amer.*, 1893, p. 33).

Generic Characters.—Head long; muzzle conical; nose-leaf simple, erect, lanceolate; nose-pad rounded; nostrils elongate, distinct; lower lip with a triangular pad bearing a longitudinal groove; ears large, united; tragus lanceolate; uropatagium large; tail long, projecting somewhat beyond the posterior margin of the uropatagium, which completely envelopes it but the free apex; calcanea short and stout. Skull with the rostrum moderately long, considerably lower than the brain-case. Dentition i. $\frac{4-4}{4-4}$, c. $\frac{1-1}{1-1}$, p. $\frac{2-2}{3-3}$, m. $\frac{3-3}{3-3}$. Median upper incisors chisel-shaped, long; lateral upper incisors weak.

Distribution.—Cuba, Haiti, Jamaica and a number of the Bahama Islands; Guatemala north to southern California and Arizona, but apparently not reaching the east coast of the mainland except in Yucatan.

History.—The genus *Macrotus* was founded by Gray on *M. waterhousii* from Haiti, and referred by him to the *Phyllostomina* close to the genus *Macrophyllum*. Wagner, in the supplement to Schreber's monumental work, placed Gray's genus in the *Megadermata* with *Megaderma*, *Rhinopoma*, *Nycteris* and *Nyctophilus*. In 1858 Baird described the Californian *M. californicus*, and, probably following Wagner, considered the genus a member of the subfamily *Megadermata*. Saussure, in 1860, in describing the Mexican *M. mexicanus*, referred the genus to the group *Phyllostomides*, but Harrison Allen, in 1864, followed Wagner and Baird, and considered it a member of the *Megadermatidæ*. Gundlach, in 1864, separated the small Cuban type as *M. minor*, while Peters, in 1865, considered the genus a member of his group *Vampyri*. Coues and Yarrow, in 1875, placed the genus in the family *Phyllostomatidæ*, in the section *Vampyri*, of which Dobson later placed it. In both of these papers *M. californicus*, *mexicanus* and *waterhousii* were considered identical. On the basis of several specimens from Guatemala, Dobson separated a species which he called *M. bocourtianus*. Harrison Allen, in 1890, separated a form of the genus from the State of Jalisco, Mexico, as *M. bulleri*, comparing it with *M. californicus*; the same author, in the 1894 edition of his *Monograph*, defended his statement made in 1864, that *M. californicus* was distinct from the West Indian *waterhousii*. Lydeker, in 1891, believing that the name *Macrotis* Dejean invalidated *Macrotus* Gray, proposed the name *Otopterus* to replace Gray's term. This action was criticised later by True and Harrison Allen, who held that *Macrotis* was little used and in construction differed from *Macrotus*.

General Relations.—As little satisfactory material of the allied genera is available, no critical remarks as to the relationship of the genus can

be made. It is without doubt a member of the present *Phyllostomatinae*, but that it is not worthy of separation from some of the types of this division is not so certain. The genus *Lonchorhina* does not appear to the author to be as close an ally as Dobson's work would lead one to suppose; and taking the allied genera broadly, *Macrotus* appears to be a very distinct type, not differentiated as strongly by skull characters as by some external developments.

Key to the Forms.

- a.—General size medium or large; skull with the interorbital region slightly and roundly depressed.
- b.—Ear medium or large (averaging 26 to 28 millimeters in length); skull with the rostrum rather heavy; interorbital region broad.
- c.—Foot quite robust, toes strong; West Indian forms.
 - d.—General color ochraceous brown or pale umber.
 - e.—First lower premolar subquadrate in basal outline; anterior width of the rostrum equal to the interorbital space.
 - f.—Upper tooth-row heavy and strongly crowded; skull large, 26.8 mm. in length, *waterhousii* Gray.
 - ff.—Upper tooth-row narrow and not strongly crowded; skull medium, not more than 24.5 mm. in length, *w. jamaicensis* n. subsp.
 - ee.—First lower premolar elongate-elliptical in basal outline; anterior width of the rostrum less than the interorbital width, *w. compressus* n. subsp.
 - dd.—General color dark umber or dark reddish-brown, *w. minor* (Gundlach).
 - cc.—Foot rather slender, toes weak; Mexican and Central American forms.
 - d.—Skull large (averaging 24.8 mm. in length); second upper premolar heavy, *mexicanus* Saussure.
 - dd.—Skull medium (averaging 23 mm. in length); second upper premolar rather weak and short, *m. bulleri* (H. Allen).
 - bb.—Ear exceptionally large (averaging over 30 mm. in length); skull quite slender with the rostrum and interorbital region narrow, *californicus* Baird.
 - aa.—General size quite small; skull with the interorbital region very broad and strongly depressed, *pygmaeus* n. sp.

Macrotus waterhousii Gray.

1843. *Macrotus Waterhousii* Gray, Proc. Zool. Soc. London, 1843, p. 21. [Hayti.]

1855. *M[acrotus] Waterhousii* Gray, Suppl. Schreber's Säugthiere, V, p. 640. [Hayti and Jamaica.] (Part.)

1865. *M[acrotus] Waterhousii* Peters, Monatsb. K. Preuss. Akad. Wissensch., Berlin, 1865, p. 503.
1878. *Macrotus waterhousii* Dobson, Catal. Chiropt. Brit. Mus., p. 464. [Haiti; St. Domingo; Jamaica.] (Part.)
1879. *Macrotus waterhousii* Alston, Biol. Cent.-Amer., Mamm., p. 38. (Part.)
1896. *Macrotus waterhousei* Elliot, Field Columbian Museum Publication, Zool. ser., Vol. I, p. 82. [San Domingo City, San Domingo.]

Type Locality.—Haiti.

Distribution.—Apparently restricted to the island of San Domingo and Haiti.

General Characters.—Size large; skull large; rostrum as wide anteriorly as the interorbital space; teeth rather heavy and robust, the first lower premolar thick, almost quadrate in basal outline; ears whitish basally.

Head.—Ears large, high; apex rounded yet with the angle apparent; internal margin with the lower half strongly arcuate, the upper half very slightly curved; internal ridge low, slight; external margin slightly arcuate, a slight incision separating a small basal portion; transverse plicæ distinct, but not strongly marked; tragus elongate-lanceolate, apex acute, internal margin straight with a slight apical emargination, external margin straight with a slight basal accessory lobule; connecting membrane distinct but not high. Eye medium in size. Nose-leaf moderately high, acute, the margins of the pad free and rounded; nostrils elliptical, directed inward and downward. Lower lip with the pad with a distinct division.

Limbs.—Forearm moderately long, considerably and evenly arcuate, thumb large and comparatively free. Femora, tibiæ and feet rather long and heavy.

Membranes and Fur.—Membranes rather heavy; propatagium rather large basally, extending to the thumb as a subequal strip of membrane with the margin totally free. Fur very long and silky, thin on the interscapular and abdominal regions and practically absent from the face, but otherwise regularly distributed; base of ears with a short growth of fine woolly hairs; muzzle with a number of long setiform hairs; volar membranes almost unhaired.

Color.—Above Prout's brown, the basal portion of the fur white, latter exposed on the thinly furred interscapular region; posterior margin and short fur on the basal portion of the ears white; below fawn color, with a silvery "bloom" caused by the silvery-white tips of the hairs. Volar and interfemoral membranes seal-brown; ears bistre.

Skull.—Robust and strongly built; brain-case rounded, moderately elevated; rostrum considerably constricted. Brain-case evenly vault-

ed, the longitudinal curve low, sagittal crest distinct and sharp; inter-orbital region slightly constricted; zygomata prominent, slightly more expanded posteriorly than anteriorly. Rostrum attenuate, the anterior width (taken behind the canines) not less than the interorbital width, the dorsal outline continuing, but less distinctly, the regular descending course from the summit of the brain-case; palate slightly vaulted, posterior portion with parallel sides, the median cleft with a sub-truncate apex; pterygoids very slender apically, moderately flaring. Mandible rather heavy, the rami strong; ascending rami stout, the coronoid process acute-angulate, condylar process broad but low; angle strong, recurved, unguical in character, distinctly bent laterally.

Teeth.—Median pair of upper incisors slender, projecting, with a narrow cutting edge; lateral upper incisors small, low, crowded, the external face distinctly channeled; upper canines projecting anteriorly, slightly recurved; first upper premolar elongate-elliptical in basal outline, advanced upon and crowding the canine, cusp anterior, low and followed by a jagged cutting edge and distinct cingulum; second upper premolar oblong in basal outline, anterior section narrowed considerably, cusp distinct, subcaniniform; first upper molar subquadrate, the paracone-metacone ridge distinct and with the two arms distinctly acute at the metacone, protocone as a low blunt ridge, hypococone almost obsolete, cingulum very weak; second upper molar similar to the first in character, but larger, distinctly quadrate and with the paracone more apparent than in the first molar; third upper molar strongly transverse and equal to the other molars in width, paracone strongly developed. Lower incisors narrow, compressed, strongly crowded between the canines, cutting edges faintly bilobate; lower canines rather strongly recurved; first lower premolar subquadrate in basal outline, advanced upon and strongly crowding the canine, cusp rather low and broad; second lower premolar very similar to the first premolar in basal outline but smaller and narrower, cusp rather sharp and rectangulate, cingulum quite distinct; third lower premolar subquadrate in basal outline, broad posteriorly, equal to the second premolar in size, cusp and cingulum much as in the second premolar; lower molars all longitudinal in basal outline, the third smaller than the others, the para- proto- metaconid group less distinct in the first than in the others, the hypo-entoconid group weaker and less distinct in the third than in the other molars.

Measurements.—Adult male (from dried skin): Length of head and body 62 mm.; ear 25; tragus 8.1; forearm 52; thumb 14.5; third digit 92.5; tibia 21; foot 15.5; greatest width of ear 17.

Skull of adult male: Total length 26.8 mm.; greatest zygomatic width 12.3; interorbital width 4.9; height at base of second premolar 4; height of brain-case 9.3; breadth of brain-case above roots of zygomatica 10; width of palatal constriction 2.3; length of palate from anterior foramina 11; width of palate including teeth 8.1; greatest length of mandible 17.3.

Remarks.—True *M. waterhousii* can readily be distinguished by the character given in the key. From the mainland forms the heavier posterior limbs and the stronger skull and teeth will distinguish it. From *w. minor* the Haitian form can readily be separated by the paler coloration as well as the much greater size; from *w. jamaicensis* by the larger size and heavier teeth; from *w. compressus* by the broader rostrum as well as the subquadrate first lower premolar.

Specimens Examined.—One skin and skull: San Domingo City, San mingo. (Field Columbian Museum.)

***Macrotus waterhousii jamaicensis* n. subsp.**

1851. *Macrotus Waterhousii* Gosse, A Naturalist's Sojourn in Jamaica, p. 295, Pl. 6, fig. 2. [Jamaica.] (Not of Gray.)

1878. *Macrotus waterhousii* Dobson, Catal. Chiropt. Brit. Mus., p. 464. [Haiti; St. Domingo; Jamaica.] (Part.)

Type.—Adult ♀; Spanishtown, Jamaica. No. $\frac{8,553}{37,543}$, U. S. National Museum. Collected by William Thomas March.

Distribution.—The island of Jamaica, where according to Gosse (*vide supra*) it is one of the commonest bats. Osborn, in Dobson (*vide supra*), states that "when inhabiting houses these bats always live in the cellars below ground, they are never found in the roofs."

General Characters.—Similar to the Haitian *M. waterhousii*, but differing in the duller coloration, the smaller skull and narrower and weaker upper tooth-row.

Head.—Ear quite large, much as in *M. waterhousii*, but the size is greater, and the transverse plicæ more distinct;² connecting membrane rather high and with a distinct central emargination; tragus as in *M. waterhousii*, but the apex is blunter. Nose-leaf and nose-pad broad, the leaf acuminate with the apex rather broad and blunt. Lower lip with the pad trigonal, the median cleft deep and very distinct.

Limbs.—The forearm and tibia are structurally as in *M. waterhousii*, but of slightly larger size; the thumb and foot are, on the other hand, of smaller size. Calcanea short and stout. Tail distinctly projecting beyond the interfemoral membrane.

Fur.—Essentially as in *M. waterhousii*.

² This is hardly visible in the type skin, but quite distinct in alcoholic specimens.

Color.—Above Prout's brown, the hair with slightly more than the basal half white. Below between drab and wood brown, the hair with the basal half white. Ears and uropatagium Prout's brown, endopatagium, mesopatagium and the greater portion of the ectopatagium clove brown.

Skull.—Similar to that of *M. waterhousii*, but slightly smaller.

Teeth.—Similar to *M. waterhousii*, but narrower and not strongly crowded; second upper premolar separated from the first premolar by a distinct space.

Measurements.—Type: Total length 90.2 mm.; head and body 63.2; ear 23; greatest width of ear 16; tragus 8.5; forearm 54.5; thumb 14.1; third digit 92; tibia 23.5; foot 13; tail 27.

Average of series: Total length [10] 93.8 mm. (90.2–103); head and body [10] 60.6 (57–67); head [9] 26 (25.5–27.5); ear [10] 26.3 (23–29); greatest width of ear [10] 18.5 (16–20.5); tragus [10] 8.8 (8–9.5); forearm [10] 53.4 (52–54.5); thumb [10] 13.4 (12–15); third digit [10] 90.3 (88–94); tibia [10] 22.3 (21.5–24); calcaneum [9] 10.4 (9.2–12); foot [10] 13.6 (12.2–16); tail [10] 33.1 (27–36).

Type skull: Greatest zygomatic width 12.2 mm.; interorbital width 4.3; height at base of second premolar 4.1; breadth of brain-case above roots of zygomata 9.5; width of palatal constriction 2.4; length of palate 11; width of palate including teeth 7.8; greatest length of mandible 16.5.

Average of three skulls: Total length [2] 24.3 mm. (24.2–24.5); greatest zygomatic width 12 (12–12.2); interorbital width 4.2 (4.1–4.3); height at base of second premolar 3.9 (3.7–4.1); height of brain-case [2] 9 (9–9.1); breadth of brain-case above roots of zygomata 9.4 (9.4–9.5); width of palatal constriction 2.2 (2.1–2.4); length of palate 9.9 (9.3–11); width of palate with teeth 7.9 (7.8–8); greatest length of mandible 16.1 (16–16.5).

Remarks.—This form requires comparison with but one other, true *M. waterhousii*, from which the compressed and spaced tooth-row will readily distinguish it. The external characters are also of service, the longer forearm and tibia and smaller foot being distinctive. From *M. w. compressus* and *minor* the characters given in the key will enable one to separate it without difficulty.

Specimens Examined.—Twelve; one skin, eleven alcoholic individuals.

Spanishtown, Jamaica. One [type]. (U. S. N. M.)

Kingston, Jamaica. One. (U. S. N. M.)

Jamaica. Two. (Biological Survey.)

Jamaica. Eight. (A. M. N. H.)

***Macrotus waterhousii compressus* n. subsp.**

Type.—Adult ♀; Eleuthera, Bahamas. No. 122,484, U. S. National Museum. July 6, 1903. Collected by S. H. Derickson.

Distribution.—Specimens have been examined from Eleuthera, New Providence, Long Island and Conch Sound, Andros, Bahamas.

General Characters.—Similar to *Macrotus waterhousii* and *M. w. jamaicensis*, but differing in the quite narrow rostrum (which is anteriorly narrower than the interorbital region) and elongate-elliptical first lower premolar.

Head.—Similar to *M. w. jamaicensis*, except that the nose-leaf and nose-pad appear to be slightly narrower and slenderer. This character appears to be only an average one, however, as the series shows considerable variation.

Limbs.—Similar to *M. w. jamaicensis*, but the forearm, tibia, third digit and tail average smaller, while the foot averages larger. In the latter respect *compressus* approaches true *waterhousii*, as their respective distribution would lead one to suppose, from which the limbs show practically no differential characters.

Fur.—Essentially as in *M. waterhousii* and *M. w. compressus*.

Color.—Above Prout's brown, the hair with more than the basal half white; fur at the base of ears and along the internal margins whitish. Below the hair is white basally, ringed with pale drab, and tipped with silvery-white. Membranes sepia, the ears and uropatagium paler than the other portions.

Skull.—Similar to that of *M. w. jamaicensis*, but with the anterior portion of the rostrum narrower than the interorbital region. The skull of true *waterhousii* can readily be separated, as it is of considerably greater size. The mandible is also seen to be slenderer than in either the Haitian or Jamaican form.

Teeth.—Similar to *M. w. jamaicensis*, but with the first upper premolar narrower and more elongate, and the first lower premolar is distinctly elongate-elliptical in basal outline instead of subquadrate. The teeth are distinctly weaker than in *M. waterhousii*, the latter having a very heavy robust dentition.

Measurements.—Type: Total length 94 mm.; head and body 69; ear 24; greatest width of ear 18; tragus 8.5; forearm 52; thumb 13.5; third digit 85; tibia 21; calcaneum 11; foot 13; tail 25

Average of series: Total length [8] 96.7 mm. (88–98); head and body [8] 64.5 (59–69); head [4] 25 (24–26); ear [8] 26 (23–29.5); greatest width of ear [8] 18.8 (17–21.5); tragus [8] 8.9 (7.5–10); forearm [8] 52.1 (49.5–54); thumb [7] 13.9 (12.8–16); third digit [7] 88.7 (84–106);

tibia [7] 21.2 (20–23.5); calcaneum [7] 10.4 (9.3–11); foot [8] 14.4 (13–16.8); tail [8] 30.9 (25–33.5).

Skull of type: Total length 25 mm.; greatest zygomatic width 10.6; interorbital 4.3; height at base of second premolar 4.1; height of brain-case 8.6; breadth of brain-case above roots of zygomatic 8.5; width of palatal constriction 2.3; length of palate 11; width of palate (including teeth) 7.6; greatest length of mandible 17.

Average of four skulls: Total length 25 mm. (25–25.1); greatest zygomatic width 11.6 (10.6–12); interorbital width 4.3 (4.2–4.5); height at base of second premolar 4 (4–4.1); height of brain-case 8.3 (8–8.6); breadth of brain-case above roots of zygomatic 9 (8.5–9.5); width of palatal constriction 2.2 (2.1–2.3); length of palate 10.6 (10.5–11); width of palate (including teeth) 7.5 (7.5–7.6); greatest length of mandible 16.9 (16.8–17).

Remarks.—The Bahaman form in general appearances approaches closer to true *waterhousii* than to *w. jamaicensis*, but the skull and teeth are decidedly different from the Haitian type and approach the Jamaican form. Taken as a whole, however, the Bahaman race is quite distinct from any other form of the genus.

Specimens Examined.—Nine; five skins, four alcoholic specimens.

Eleuthera, Bahamas. One [type]. (U. S. N. M.)

Gregorytown, Eleuthera, Bahamas. Two. (U. S. N. M.)

Georgetown, Eleuthera, Bahamas. Three. (U. S. N. M.)

Nassau, New Providence, Bahamas. One. (U. S. N. M.)

Conch Sound, Andros, Bahamas. One. (A. M. N. H.)

Long Island, Bahamas. One. (U. S. N. M.)

***Macrotus waterhousii minor* (Gundlach).**

1864. *Macrotus minor* Gundlach, Monatsbr. K. Preuss. Akad. Wissensch., Berlin, 1864, p. 382. [Cuba.]

1873. *M[acrotus] Waterhousei* Gundlach, Anales Soc. Españ. Hist. Nat., I, cuad. 3, p. 239. [Cuba.] (Not of Gray.)

1878. *Macrotus waterhousii* Dobson, Catal. Chiropt. Brit. Mus., p. 464. (Part.)

1904. *Macrotus waterhousii* Miller, Proc. U. S. Nat. Mus., XXVII, p. 344. [Guanajay, El Cobre, Cuba; Nueva Gerona, Isle of Pines.] (Not of Gray.)

Type Locality.—Cuba. From remarks made by Gundlach in a later paper (*vide supra*) we learn that his material was from western Cuba.

Distribution.—Cuba and the Isle of Pines. Gundlach says it is a common species in some warehouses and caves, where individuals pass the day side by side suspended by the hind limbs.

General Characters.—A member of the *Macrotus waterhousii* group but readily separated by the smaller size and the deeper coloration. The Cuban form is such a distinct type, with small light skull and weak teeth, that it hardly requires comparison.

Head.—Essentially as in *M. waterhousii jamaicensis*.

Limbs.—As in *M. w. jamaicensis*, but slightly smaller.

Fur.—As in the other forms of the *waterhousii* group, except that the furring of the base and proximal part of the internal margin of the ear is more marked than in any other form.

Color.—Apparently two extreme types of coloration exist in this form, which may be sexual, but the available material is not in condition to justify any statement beyond the fact that the two phases exist. The one extreme is a deep brown, while the other (represented by but one skin) is a rather dark ferruginous. Two specimens have a slight tendency toward the ferruginous type, the upper surface being slightly suffused with that tint while the lower surface is that of the brown form. Brown phase: Above seal brown, the hair with slightly more than the basal half white, region between the ears and posterior to the connecting membrane blackish; below the hair is white basally, then conspicuously annulate with drab and rather obscurely tipped with silvery; membranes blackish-brown. This type is distinctly darker, both above and below, than any of the other West Indian forms. Red phase: Above and below dull ferruginous, the hair unicolor; patch between the ears blackish; membranes black. In one of the apparently intermediate specimens mentioned above, the hair of the upper surface is whitish basally with a median annulation of smoke gray.

Skull.—Of the general type of *M. waterhousii*, but distinctly smaller than any of the related forms. As specimens from the eastern part of Cuba approximate slightly toward the Jamaican type, a slight difference in size is noticed in comparing the skulls of individuals from the two extremes of the island.

Teeth.—Essentially as in *M. w. jamaicensis*, but the first upper premolar is slightly narrower and the lower premolars are distinctly more longitudinal and compressed. This latter character alone will immediately demonstrate the fact that while specimens from the eastern part of the island slightly approach *jamaicensis*, they are inseparable from typical *minor* from western Cuba, when the dentition is considered.

Measurements.—Average of twelve specimens: Total length 90.7 mm. (84.5–96.5); head and body 59.9 (55.5–65); head 25.1 (25–30); ear 26.3 (21.5–30); greatest width of ear 17.3 (15–19); tragus 8.6 (7.8–10); forearm 51.4 (49–54); thumb 14.1 (12.5–15); third digit 85.1 (81–88); tibia 21.2 (19–22.5); calcaneum 10.9 (8.5–12.3); foot 13 (10.5–15.5); tail 30 (20–37).

Average of five skulls: Total length 23.8 mm. (23.5–24.3); greatest zygomatic width 11.3 (11–12); interorbital width 3.9 (3.5–4.1); height

at base of second premolar 3.8 (3.5-4); height of brain-case 8.3 (8-8.8); breadth of brain-case above roots of zygomata 9.1 (9-9.2); width of palatal constriction 2.1 (2-2.2); length of palate 9.7 (9.2-10); width of palate (including teeth) 7.3 (7-8); greatest length of mandible 15.4 (15-16).

Remarks.—The Cuban form *minor* is quite distinct from any of the related forms except the Jamaican *Macrotus waterhousii jamaicensis*. The specimens from eastern Cuba somewhat approach this latter race, as already noticed by Gundlach (*vide supra*), but the general characters of the race are retained and the smaller size and weaker teeth, as well as the deeper coloration, will serve to distinguish the two races.

Specimens Examined.—Twenty-eight; four skins, twenty-four alcoholics:

Guanajay, Pinar del Rio, Cuba. Three. (U. S. N. M.)

Nueva Gerona, Isle of Pines. Three. (U. S. N. M.)

El Cobre, Santiago, Cuba. Two. (U. S. N. M.)

Santiago de Cuba, Cuba. Twenty. (U. S. N. M.)

***Macrotus mexicanus* Saussure.**

1860. *Macrotus mexicanus* Saussure, Revue et Magasin de Zoologie, 2^e ser. XII, p. 486. [Cuautla, near Yautepec, Morelos, Mexico.]

1865. *M[acrotus] mexicanus* Peters, Monatsb. K. Preuss. Akad. Wissensch., Berlin, 1865, p. 504.

1876. *Macrotus bocourtianus* Dobson, Ann. and Mag. Nat. Hist., 4th ser., XVIII, p. 436. [Vera Paz, Guatemala.]

1878. *Macrotus waterhousii* Dobson, Catal. Chiropt. Brit. Mus., p. 464. (Part.)

1878. *Macrotus bocourtianus* Dobson, Catal. Chiropt. Brit. Mus., p. 467 [Vera Paz, Guatemala.]

1879. *Macrotus waterhousii* Alston, Biol. Cent.-Amer., Mamm., p. 38 (Part.)

1879. *Macrotus bocourtianus* Alston, Biol. Cent.-Amer., Mamm., p. 38 [Vera Paz, Guatemala.]

1898. *Otopterus mexicanus* Merriam, Proc. Biol. Soc. Wash., XII, p. 18 [Morelos, Mexico.]

Type Locality.—Cuautla, near Yautepec, Morelos, Mexico.

Distribution.—From Colima, Michoacan, and Morelos, Mexico, south to Vera Paz, Guatemala.

General Characters.—Size large; ears rather large; limbs robust; skull heavy, the rostrum not narrower than the interorbital region; teeth heavy, the first upper premolar moderately compressed, the third lower premolar somewhat crowded.

Head.—Ear, when stretched forward, extending beyond the muzzle a distance not exceeding the length of the nose-leaf; internal margin strongly arcuate basally, gently so apically; apex rather narrowly rounded; external margin slightly curved, basal notch distinct, basal lobe rather low; tragus lanceolate, apex acuminate, external basal

lobe low; internal connecting membrane rather high, with a slight median emargination. Nose-leaf acute; nose-pad with the inferior margin more or less free; nostrils crescentic. Pad on the lower jaw trigonal, median incision of varying depth, but usually rather broad and shallow.

Limbs.—Forearm long and heavy, with a distinct and even arcuation. Posterior limbs moderately robust (for the genus), femora and tibiae of equal length; foot about half the length of the femur, rather heavy; calcaneum thick and flattened. Tail rather long, one or one and a half terminal joints free.

Membranes and Fur.—Essentially as in the *waterhousii* group.

Color.—Two color phases are present in the series examined—one dark brown the other of a more rufescent type—between which two extremes are a number of intermediate specimens. Dark brown phase: Above bistre with a slight overlying silvery “bloom,” the basal three-fifths of the hair white; below wood brown, the hair with the basal section as above, the whole with the tips of the hair white; hair at the base of the ears and the auricular hairs whitish; membranes bistre. Rufous brown phase: Above cinnamon, slightly more than the basal half of the hair white; below the hair white basally, then ringed with cinnamon, and tipped with ecru drab, thus producing a paler color than that of the upper surface; hair at the base of the ears and auricular hairs whitish; membranes mummy brown.

Skull.—Similar to *M. waterhousii*, but slightly smaller, with the inter-orbital region more depressed and the rostrum slightly slenderer.

Teeth.—As in *M. waterhousii*, except that the canines are distinctly weaker, the first upper premolar is more compressed, the second upper premolar slightly longer, and the lower tooth-row more compressed.

Measurements.—Average of four Cuernavaca specimens: Total length 93.1 mm. (87–101); head and body 59.8 (56.5–64); head 24; ear 25.2 (24–27); greatest width of ear 17.7 (17–18.5); tragus 9.2 (9–9.6); forearm 49.6 (47.5–51.5); thumb 12.5 (11.5–13); third digit 87.1 (85.5–90); tibia 21.2 (21–21.5); calcaneum 10.3 (9–11.3); foot 12.7 (11.8–13); tail 33.5 (30–37).

Average of eight Tehuantepec skins: Total length [1] 100.5 mm.; head and body 60.9 (57–69); head [1] 29.2; ear 26 (24–28.5); greatest width of ear [3] 18.8 (17.9–19.5); tragus 8.5 (8–10); forearm 52.5 (51–53.5); thumb [7] 12.3 (12–13.5); third digit [5] 87.8 (87–89); tibia 22.2 (20–23.5); calcaneum 10 (9–11); foot 13.1 (13–13.5); tail [1] 31.5.

Average of eight skulls from Tehuantepec and Reyes, Oaxaca: Total length 24.8 mm. (24–25.5); greatest zygomatic width 12 (11.5–12.5);

interorbital width 4.1 (3.9–4.5); height at base of second premolar 3.7 (3.5–3.9); height of brain-case 9 (8.1–9.5); breadth of brain-case at roots of zygomata 9.2 (9–9.6); width of palatal constriction 2.2 (2–2.5); length of palate 9.4 (9–9.8); width of palate (including teeth) 8 (7.9–8.2); greatest length of mandible 16.4 (16–17.6).

Remarks.—The *Macrotus mexicanus* group is closely related to the West Indian *waterhousii* group, from which, however, it can be distinguished by the characters mentioned above. The slenderer build, larger ears and lighter skull will at once separate *M. californicus* from this form, while the race *bulleri* is a smaller type of the *mexicanus* character quite easily recognized.

Dobson's *Macrotus bocourtianus* is, no doubt, simply the extreme development of this form, and his measurements are almost identical with those of the type of *mexicanus* given by Saussure. Specimens from Tehuantepec average larger than Morelos specimens, but some specimens in the same series are smaller than Cuernavaca individuals, and as no other characters appear to be at variance, they should be considered extreme *mexicanus*. Many of Dobson's measurements of *bocourtianus* are smaller than the average of four Cuernavaca specimens examined, and in several cases are actually smaller than the same measurements of Saussure's type.

Specimens Examined.—Nineteen; eleven skins, eight alcoholic specimens:

Colima, Colima. Two. (Biol. Surv.)

La Salada, Michoacan. Five. (Biol. Surv.)

Cuernavaca, Morelos. Four. (Biol. Surv.)

Reyes, Oaxaca. One. (Biol. Surv.)

Tehuantepec, Oaxaca. Seven. (A. M. N. H. and Field Columbian Mus.)

***Macrotus mexicanus bulleri* (H. Allen).**

1889. *Macrotus californicus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., II, p. 166. [Bolaños, Jalisco, Mexico.] (Not of Baird.)

1890. *Macrotus bulleri* H. Allen, Proc. Amer. Philos. Soc., XXVIII, p. 73. [Bolaños, Jalisco, Mexico.]

1894. *Macrotus bulleri* H. Allen, Monogr. Bats N. Amer., p. 41. [Bolaños, Jalisco, Mexico.]

1898. *Otopterus mexicanus* Merriam, Proc. Biol. Soc. Wash., XII, p. 18. [Maria Madre, Tres Marias Islands.] (Not of Saussure.)

1898. *Otopterus bulleri* Merriam, Proc. Biol. Soc. Wash., XII, p. 18. [Bolaños, Jalisco, Mexico.]

1899. *Otopterus mexicanus* Nelson, North American Fauna, No. 14, p. 18 [Maria Madre, Tres Marias Islands.] (Not of Saussure.)

Type Locality.—Bolaños, Jalisco, Mexico.

Distribution.—From Guadalajara north to Durango and southern Chihuahua, also including the Tres Marias Islands.

General Characters.—Similar to *M. mexicanus*, but smaller, with the dentition more crowded, and the second upper premolar shorter and somewhat weaker.

Head.—As in *M. mexicanus*, except that the ears are larger.

Limbs.—As in *M. mexicanus*, but rather slenderer, the foot and calcaneum distinctly weaker.

Membranes and Fur.—As in *M. mexicanus*.

Color.—This race occurs in two phases, one of which appears to be that of immaturity. The dark brown type, which is apparently the immature coloration, is connected by intermediates with the dull rufescent brown type. Brown phase: Above bistre, the hair with the basal half white; base of ears and auricular hairs whitish; below drab, the hair white at the base and tipped with silvery-white; membranes clove brown. Red phase: Above between chestnut and hazel (Ridgway's *Nomenclature of Colors*, pl. iv), the hair light and rather vinaceous basally; base of ears and auricular hairs of the under color of the upper surface; below dull pinkish vinaceous; membranes between chestnut and liver brown. The intermediate specimens have the upper surface cinnamon rufous, while of this type has the extreme base of the hair smoke-gray, thus making the hair triannulate—smoke gray, white and cinnamon rufous. The original series of this race was composed entirely of immature individuals and accordingly all are of the dark brown type.

Skull.—Very similar to that of *M. mexicanus*, but distinctly smaller, with the rostrum, for its size, heavier.

Teeth.—As in *M. mexicanus*, but the second upper premolar is without the produced anterior shoulder noticed in *mexicanus*, and the inferior premolars are comparatively shorter and broader.

Measurements.—Average of five alcoholic topotypes: Total length 87.6 mm. (84.5–92); head and body 55.1 (53.5–56.5); head 23 (22.5–23.5); ear 28.5 (27–30.5); greatest width of ear 19.2 (18.5–20.5); tragus 9.5 (9–10); forearm 49.2 (48.5–50.5); thumb 12.6 (12–13.2); third digit 83.8 (81–87); tibia 20.2 (19–21); calcaneum 10.6 (10–11.2); foot 12.4 (12–13); tail 32.5 (30.5–35.5).

Average of eleven topotypic and Guadalajara skulls: Total length 23 mm. (22.5–23.5); greatest zygomatic width 10.8 (10.5–11.1); interorbital width 4 (4–4.2); height at base of second premolar 3.6 (3.3–4); height of brain-case 8.2 (8–9); breadth of brain-case above roots of zygomata 8.6 (8.3–9); width of palatal constriction 2 (2–2.3); length of palate 8.6 (8.3–9); width of palate (including teeth) 7.4 (7–7.8); greatest length of mandible 15 (14.6–15.5).

Remarks.—This well-marked race of *mexicanus* can be easily recognized by the smaller size, the weak second upper and distinctly crowded third lower premolars. The Tres Marias specimens appear to be inseparable from the mainland form.

Specimens Examined.—Fifty-two; twenty-seven skins, twenty-five alcoholic individuals:

Near Batopilas, Chihuahua. Four. (Biol. Surv.)

Chacala, Durango. Five. (Biol. Surv.)

Bolaños, Jalisco. Twenty-one. (A. M. N. H., Biol. Surv., and Field Columb. Mus.)

San Pedro, near Guadalajara, Jalisco. Five. (A. M. N. H.)

Ameca, Jalisco. Six. (Biol. Surv.)

Maria Madre, Tres Marias Islands, Tepic. Eleven. (Biol. Surv.)

***Macrotus californicus* Baird.**

1858. *Macrotus Californicus* Baird, Proc. Acad. Nat. Sci. Phila., p. 116. [Fort Yuma, California.]

1859. *Macrotus californica* Baird, Rep. U. S. and Mexican Boundary Survey, Vol. II, Pt. 2, Mamm., p. 4, Pl. 1, fig. 2. [Fort Yuma, California.]

1864. *Macrotus californicus* Allen, Monogr. Bats N. Amer., p. 3, figs. 2 and 3. [Fort Yuma, California; Cape St. Lucas, Lower California.]

1865. *M[acrotus] californicus* Peters, Monatsb. K. Preuss. Akad. Wissensch., Berlin, 1865, p. 504.

1875. *Macrotus waterhousii* Coues and Yarrow, Rep. Expl. Surv. W. 100th Merid., V, p. 80. (Not of Gray.)

1878. *Macrotus waterhousii* Dobson, Catal. Chiropt. Brit. Mus., p. 465. [Cape St. Lucas, Lower California.] (Part.)

1879. *Macrotus waterhousii* Alston, Biol. Cent.-Amer., Mamm., p. 38. (Part.)

1894. *Macrotus californicus* Allen, Monogr. Bats N. Amer., p. 34, Pls. 1 and 2. [Fort Yuma, California; Cape St. Lucas, Lower California; near Tucson, Arizona.]

1901. [*Otopterus*] *californicus* Elliot, Field Columb. Mus. Publication, Zool. ser., II, p. 420.

Type Locality.—Fort Yuma, San Diego county, California.

Distribution.—Arid region of the southwestern United States, Lower California and Sonora. Specimens have been examined from as far east as Tombstone, Cochise county, Arizona, west as far as De Luz, San Diego county, California, and from as far south as Camoa, Rio Mayo, Sonora, and Cape St. Lucas. Cape St. Lucas and Sonoran specimens are slightly smaller than topotypes, but are otherwise indistinguishable.

General Characters.—Size large; form slender, ears extremely large, subovate in outline; limbs very slender; skull slender, rostrum narrow; teeth weak; colors usually pale.

Head.—Elongate, slender; rostrum rather attenuate; brain-case moderately elevated. Ear very large, elliptical, when stretched forward, exceeding the muzzle by a third the entire length of the append-

age; internal border arcuate, strongly so basally; apex blunt rectangulate; external margin very slightly curved, almost straight; basal lobe low, but separated by a distinct notch; transverse plicæ weak, separated; internal ridge narrow, rather inconspicuous; interauricular membrane moderately high with a rounded median emargination; tragus lanceolate, greatest width not more than a third of the length, apex attenuate, internal margin moderately arcuate at the base, external margin with a pair of slight accessory lobes at the base. Eye of medium size. Nose-leaf blunt lanceolate, higher than the width of the pad; nostrils crescentic; nose-pad with the margins free to a greater or less extent. Lower jaw with the pad triangular and of medium size, divided more or less distinctly.

Limbs.—Forearm moderately robust, slightly bowed; thumb long and slender. Posterior limbs slender and weak, the feet narrower and with the toes strongly compressed. Tail slender, exceeding the apical margin of the interfemoral membrane by the length of one or one and a half vertebræ.

Membranes and Fur.—Membranes thin and rather weak; propatagium deep proximally, very narrow distally, but with the margin free to the thumb; uropatagium large, apical margin subtruncate; endopatagium with the nerves extending parallel to the humerus and femur; mesopatagium with the nerves with a general antero-posterior trend. Fur thick and long, rather silky in texture, uniform in distribution except on the interauricular region of the head, which is partially bare; ear with the posterior and internal bases as well as the anterior margin very distinctly haired, the anterior margin with the hair long and scattered.

Color.—Upper surface ranging from pale drab to mars brown, the basal two-thirds of the fur white, which shows through distinctly at the nape and on the crown, at which latter point the brown tips are almost absent in some specimens. Under surface ranging from ecru drab to broccoli brown, the hair white basally and with silvery tips, the latter being more marked in some individuals than in others. Hair at base and on the margin of the ears whitish. Membranes and muzzle appendages Prout's brown.

Skull.—Slender, elongate, rostrum produced and moderately acuminate. Brain-case slightly compressed, evenly arched; sagittal crest low and weak; interorbital constriction distinct, not or very slightly wider than the width of the rostrum at the canines; zygomata with the greatest width posterior, not arched. Rostrum at the orbits twice as wide as at the canines, gently acuminate and passing into the brain-

case without any abrupt depression; palate with the posterior portion rather broad, subequal. Mandible rather slender; ascending rami low, coronoid process rather sharp, condylar process broad but compressed, angle recurved, deflected laterally to a considerable extent.

Teeth.—Central pair of superior incisors slender, compressed, distinctly projecting forward; lateral upper incisors of about the same basal area as the median pair, but very low, not one-fourth the height of the median pair. Upper canines slightly flaring, subreniform in basal outline; first upper premolar elongate, strongly compressed, cusp low and placed anteriorly; second upper premolar touching and slightly overlapping the first, elongate pyramidal in basal outline, the apex interior and deflected toward the internal margin of the tooth-row, cusp moderately high; first upper molar narrowed anteriorly, metacone inconspicuous and pressed against the hypocone-metacone ridge; second upper molar quadrate, cusps regularly placed; third upper molar strongly transverse. Lower incisors small, compressed, edges very faintly bilobate; lower canines slightly recurved; first lower premolar oblong in basal outline, the internal margin slightly rounded, cusp obtuse and low; second and third lower premolars similar in basal outline, oblong, the third not more crowded than the second; first lower molar smaller than the second, cusps similar in character except that the entoconid is distinctly stronger in the second than in the first tooth; third lower molar with the meta-paraconid section very slight and weak in strong contrast to the distinct and heavy ento-metaconid fold.

Measurements.—Average of series of five alcoholic topotypes: Total length 88.6 mm. (84.5–92.5); head and body 54.7 (50–58); head 23.8 (22.5–25); ear 30.7 (28–33); greatest width of ear 21.2 (20.5–22.5); tragus 10.9 (10–12); forearm 50.5 (49.3–51); thumb 11.9 (10.8–12); third digit 79.9 (77–83); tibia 21.7 (21–22.2); calcaneum 11.5 (10.2–12.8); foot 11.5 (11–12.5); tail 33.9 (30–37).

Average of six skulls: Total length 23.5 mm. (23–24.1); greatest zygomatic width 11.5 (11–12); interorbital width 3.9 (3.8–4); height at base of second premolar 3.5 (3–3.9); height of brain-case 8.1 (8–8.8); breadth of brain-case above roots of zygomatics 8.7 (8.4–9); width of palatal constriction 2.2 (2–2.5); length of palate 9.5 (9.2–10); width of palatal constriction 7.3 (6.9–7.9); greatest length of mandible 15.7 (15.2–16).

Remarks.—This species can be distinguished from the *waterhousii* group by the slenderer structure of the whole body and skull the longer ear and the weaker dentition.

From *M. mexicanus* and *M. bulleri*, *californicus* can be distinguished by the characters given in the key.

The Cape St. Lucas specimens are slightly differentiated from the typical Yuma specimens, but the differences are so extremely slight that they would not justify the separation of the Cape series.

Specimens Examined.—Fifty-nine; twenty-one skins, thirty-three alcoholic individuals:

Yuma, Arizona. Five. (Biol. Surv.)

Thirty-five miles east of Yuma, Arizona. Two. (U. S. N. M.)

Parker, Yuma county, Arizona. One. (U. S. N. M.)

San Xavier, Pima county, Arizona. One. (U. S. N. M.)

Arizona. Five. (A. M. N. H.)

Tombstone, Cochise county, Arizona. Two. (Biol. Surv.)

Vallecito, San Diego county, California. Seventeen. (Biol. Surv. and U. S. N. M.)

De Luz, San Diego county, California. Two. (Biol. Surv.)

Indian Wells, San Diego county, California. Four. (U. S. N. M.)

Ortiz, Sonora, Mexico. One. (Biol. Surv.)

Camoa, Sonora, Mexico. Eleven. (Biol. Surv.)

Cape St. Lucas, Lower California. Eight. (A. N. S. Phila. and U. S. N. M.)

***Macrotus pygmæus* n. sp.**

Type.—Adult skin and skull; Izamal, Yucatan. No. 12,756|11,043, American Museum of Natural History. Collected by George F. Gaumer.

Distribution.—Known only from the type locality.

General Characters.—Size extremely small (for the genus); skull with the interorbital region very broad and distinctly flattened; teeth large and strongly crowded.

Head.—Ear rounded; internal margin evenly arcuate; apex rounded with but a slight trace of an angle; external margin evenly arcuate, basal notch very slight, basal lobe subobsolete; transverse plicæ distinct; interauricular membrane distinct and moderately high; tragus lanceolate, apex rather blunt, external margin with a slight basal accessory longitudinal lobule. Nose-leaf high, lanceolate, with the nose-pad over twice as high as the width of the pad; apex rather acute; nostrils slightly crescentic. Extremity of lower jaw with the triangular pad bearing a shallow median depression.

Limbs.—Forearm short, robust, evenly arcuate. Thumb rather long, enveloped in membranes for more than half its length. Third digit moderately long. Posterior limbs heavy; feet strong and but moderately compressed; calcanea long, stout and compressed.

Membranes and Fur.—Membranes thick and leathery; propatagium broad. Fur long, silky above, woolly below; skin of the head at the base of the ears and the interorbital region bare; base of ears and greater part of the internal margin of the ear clothed with long hair; muzzle with a number of long setiform hairs.

Color.—Above mars brown, the hair grayish white basally; below ecru drab, the hair unicolor; flight membranes clove brown; ears and nasal appendages Prout's brown; auricular hairs the color of the upper surface.

Skull.—Light and rather fragile; brain-case strongly elevated above the rostrum. Brain-case when viewed from the posterior aspect sub-tectate, evenly arched longitudinally; sagittal crest distinct; zygomatica rather evenly arched, but greatest width posterior; interorbital region broad, depressed, curving evenly toward the rostrum and the brain-case. Rostrum moderately produced, rather low, width at canines considerably less than the interorbital width; palate rather narrow, shallowly excavated, posterior extension rather broad with the cleft acute-angulate with the apex blunt; pterygoids strongly divergent. Mandible rather long; ascending ramus low; coronoid process blunt; condylar process broad transversely; angles blunt, divergent.

Teeth.—Median pair of upper incisors narrow, cutting edges entire; lateral upper incisors very small, low and without a distinct cusp or other structure; upper canines rather heavy, slightly divergent; first upper premolar subelliptical in basal outline with a distinct median constriction, cusp rectangulate and low; second upper premolar crudely pyramidal in basal outline, the internal posterior margin bearing a distinct rounded shoulder; molars of the type usual in the genus. Lower incisors narrow, compressed; lower canines rather heavy, divergent, projecting slightly forward; lower premolars subquadrate in basal outline, the first and third more longitudinal than the second, cusp of the first tooth rectangulate, of the second and third acute; first lower molar with the para-proto-metaconid group much less sharply defined than in the other lower molars; third lower molar with the hypo-entoconid group reduced as in the other members of the genus.

*Measurements.*³—Total length 79.3 mm. (Gaumer); head and body 46; ear 17.2; greatest width of ear 13; tragus 7; forearm 35.5; thumb 10; third digit 65.5; tibia 14.9; calcaneum 9; foot 10.5; tail 28 (Gaumer); nose-leaf and nose-pad, 7.2.

Skull: Greatest zygomatic width 9.2 mm.; interorbital width 4.2;

³ From dried skin, unless otherwise credited.

height at base of second premolar 3.2; height of brain-case 7.6; breadth of brain-case above roots of zygomata 8; width of palatal constriction 2; length of palate 8; width of palate (including teeth) 6.5; greatest length of mandible, 12.8.

Remarks.—This diminutive species is so very distinct that no further comparison or special comment is necessary.

Specimens Examined.—One, the type.